Chapter One: The Setting

In describing the Ohio River in the early nineteenth century Samuel Cumings, like many who saw and wrote about the river in its natural state, stressed its "wild and picturesque grandeur, which those who have never viewed nature in her primitive and unspoiled state, can hardly imagine."[1] For the town-builders of Madison, Indiana, the acknowledged beauty and majesty of the river meant not nearly so much as the water that was in it. Water furnished not only the most abundant and accessible form of energy; it provided the easiest and most accessible highway for the pioneer into the "wild and picturesque" land that Cumings described. The Ohio River, Charles Ambler has written, "is the main thoroughfare between the Atlantic coast and the Mississippi Valley. By way of its waters, more than any other route, a whole new continent was peopled."[2]

The proprietors of Madison, John Paul, Jonathan Lyons, and Lewis Davis, laid out the original plat of the town in the fall of 1810, and sold the first lots in February of the following year. They had chosen, they thought, one of the "healthiest" and best situated locations on the Ohio River between Cincinnati and Louisville. It bordered the Ohio River on an extended tract of bottom land measuring some three-quarters of a mile in width, several miles in length, ringed by an amphitheater of hills rising

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[1]Samuel Cumings, The Western Pilot (revised edition, Cincinnati, 1838), 6-7.

[2]Charles Henry Ambler, A History of Transportation in the Ohio Valley (Glendale, California, 1932), 17.

some 400 feet. The land within the amphitheater rose in two inclined planes from the river, the second bank thirty-five or forty feet above the level of the first.[3] The waters of Crooked Creek, parallel to the Ohio River at the base of the hills and joining it below the town, make this location a convex peninsular tongue of land sloping toward both creek and river. To the north, above the town site, a long hollow runs back into the hills about two miles to the headwaters of Crooked Creek. The sloping features of the site made it "high, dry and healthy." Its location on the Ohio River made it accessible to commerce.

The westward-moving pioneer received the water of the Ohio River as nature's gift--a gift of truly gigantic proportions. Draining an area of 214,000 square miles with an average annual rainfall of 41.5 inches, the Ohio annually discharges an estimated 5 trillion cubic feet of water into the Mississippi River at Cairo, Illinois. No other river in the United States except the Missouri and Lower Mississippi drains a region of equal extent, and only the Lower Mississippi carries more water. The Ohio River furnishes approximately one-fourth of all the water discharged by the mouths of the Mississippi into the Gulf of Mexico.[4] This bountiful river provided the pioneer with a highway reaching over 1,000 miles into the West. He depended on its waters for transportation--living and traveling on it for weeks,

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[3]Testimony of John Vawter, Trustees of the City of Madison vs. John Paul, et al, Jefferson Circuit Court Record, July 24, 25, and August 16, 22, 1833, typescript (Jefferson County Library, Madison, Indiana), 3.

[4]W. Milnor Roberts, "Survey of the Ohio River" (1870), U. S. House Executive Document, No. 72, 41 Cong., 3 Sess. (serial 1454), 27-28; hereafter Roberts, "1870 Survey." Although the Missouri River Basin had a drainage area of 518,000 square miles, it had an annual rainfall of only 20.9 inches, giving an annual discharge of 3,780,000,000,000 cubic feet into the Mississippi.

sometimes months, in quest of the main chance. When he settled he looked to the river for export of his surplus produce and import of his needs.

The Ohio's "graceful, sweeping curves" make the distance between Pittsburgh and Cairo approximately 1,015 miles, while the present day airline distance measures about 550 miles. Between Pittsburgh and Cairo the river falls 426 feet, 5.1 inches per mile.[5] The meandering nature of the river and its moderate declivity slows the water to an average velocity of less than 3 miles per hour, and as little as 1 mile or less per hour in deeper pools.[6] Even at the height of the worst antebellum floods in 1832 the river reached a velocity of only 6.2 miles per hour.[7] This slow movement made ascent easier, first by keelboat, later by steamboat; perhaps more important, it increased the time during which water remained in the river.

During the seasonal high water stages of spring and autumn, the Ohio River appeared as a vast pool extending from Pittsburgh to Cairo. As high water receded, the river's divisions appeared. A natural rock dam which made a fall of 26 feet in a running distance of about 3 miles, separating the Upper and Lower Ohio River at Louisville, constituted the only major obstacle

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[5]W. Milnor Roberts, "River and Harbor Improvements" (1866), U. S., House Executive Document, No. 56, Part 2, 39 Cong., 2 Sess. (serial 1291), 270; hereafter Roberts, "1866 Survey."

[6]Elias Pym Fordham, Personal Narrative of Travels in Virginia, Maryland, Pennsylvania, Ohio, Indiana, Kentucky; and of Residence in the Illinois Territory; 1817-1818, Frederic Austin Ogg, ed. (Cleveland, 1906), 3; U. S. Engineer's Report on the State of the Ohio River" (1901), cited in Isaac Lippincott, A History of Manufactures in the Ohio Valley to the Year 1860 (New York, 1914), 11.

[7]James Hall, The West: Its Soil, Surface, and Productions (Cincinnati, 1848), 32.

in the waterway's whole course.[8] Three channels ran through the falls but according to one source, river pilots considered best the passage on the Indiana side, called the Indiana Chute.[9] The opening of the Louisville and Portland Canal in 1830 reduced the importance of this obstacle to navigation but did not eliminate it. By the 1840s the canal could not carry the larger-size steamboats and the falls remained a hindrance to navigation as the size of steamboats increased.[10]

Further recession of the water revealed the river to be a succession of 187 pools over 7 feet in depth separated by natural dams. Some of these dams or bars were sandy, some light gravel, some heavy, and some, such as the falls at Louisville, rocky shoals. These natural dams varied from a few hundred yards to several miles in width and constituted the next most serious obstruction to navigation. The dams did serve two important functions: they prolonged the period of navigation by retaining great quantities of water, which otherwise would rapidly run off; and they acted as a brake, slowing the current by creating a "very gentle and almost sluggish" pool current.[11] The pools varied in length from .5 mile to 15.5 miles, with a combined length of 632.5 miles; 127 pools lay above the falls, totalling 363 miles in length; 60 pools lay below the falls, totalling 266 miles.[12]

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[8]Roberts, "1870 Survey," 7.

[9]John Melish, Travels in the United States of America, in the Years 1806 and 1807, and 1809, 1810, 1811 (2 vols., Philadelphia, 1812), II, 151.

[10]Thomas Senior Berry, Western Prices before 1861: A Study of the Cincinnati Market (Cambridge, 1943), 40.

[11]Roberts, "1870 Survey," 67.

[12]Ibid., 153.

Lieutenant John Sanders in 1838 divided the Upper Ohio into six sections, and identified the sixth, from Cincinnati to Louisville, as "certainly the most important." He explained that the importance of this section resulted first from the fact that "it unites two such important points as Louisville and Cincinnati" which the commerce of the upper sections had to pass; and second because the "river experiences less change than anywhere else, and requires less improvement in proportion to distance."[13] By improvement Sanders meant erection of "riprap" or wing-shaped dams, which concentrated the flow of water over the bars to maintain a minimum of 3 feet in the channel. The founders of Madison possibly knew of the good navigation qualities of this section of the river; as early as 1808, Cramer had described it in his guide to the Ohio.[14]

Madison, 86 miles below Cincinnati and 43 miles above Louisville, was on the most navigable water in the "most important" section of the river (see Appendix A). On this 129-mile section there were 28 separate pools totaling 109 miles and averaging 3.9; the average length of pools in the Upper Ohio as a whole was 2.8. Between Cincinnati and Madison the river contained 23 pools totaling 71 miles and averaging just over 3.1 miles, only a little longer than the upper-river average as a whole. Between Madison and Louisville, a river distance of 43 miles, Roberts noted five pools totaling 38.0 miles and averaging 7.6 miles, more than twice the upper-river average. Thirteen bars lay between Cincinnati and Madison, with eleven over 1 mile in width, and three

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[13] John Sanders, "Improvement of the Ohio River Above the Falls," (1838), U. S., Senate Document, No. 1, 25 Cong., 3 Sess. (serial 338), 316; hereafter Sanders, "1838 Survey."

[14] Zadok Cramer, The Navigator (sixth edition, Pittsburgh, 1808), 66-71.

more than 2 miles in width. Between Madison and Louisville there were five bars, four measuring over 1 mile in width; one of these, Cooper's Bar, 11,870 feet, over 2 miles wide. The river between Cincinnati and Madison only twice the length of the river between Madison and Louisville, therefore had almost three times the number and size of obstructions as the latter span of river.[15] Judged on the basis of pool length, and number and size of obstructions, the Madison-Louisville span of the river constituted one of the most navigable sections of the river above the falls at Louisville.

Zadock Cramer, author of the most widely used guide to the Ohio River, in 1808 wrote, "From Kentucky [13 miles] above Madison to Westport [23 miles below] you have fine water." He mentioned only one sand bar between Madison and Louisville.[16] Samuel Cumings, author of another widely used guide, noted four bars in the same stretch of river in 1836, but only two were designated as "large": Cooper's Bar, 5 miles below Madison; and "Meadow Ground," 28 miles below the city.[17] One of the main reasons for the early and continued existence of "fine water" between Madison and Louisville was the absence of any major tributaries entering the Ohio from either the Indiana or Kentucky sides, while between Madison and Cincinnati, a number of major tributaries, particularly the Miami and Kentucky rivers, flow into the Ohio. These tributaries flowed swiftly and carried their sediment with them until, upon joining the slower-moving Ohio, they deposited it on bars.

In the antebellum period boatmen generally regarded about 5 to 6 feet

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[15]Roberts," 1870 Survey," 145-47.

[16]Cramer, Navigator, 71.

[17]Cumings, Western Pilot, 47-49.

of water in channels as a fair stage for running and above 40 feet as unsatisfactory, because of the dangers of floating debris.[18] The river usually opened in February or March, with a long spring season of high water and free navigation, followed by a long summer of declining water levels and obstructed navigation and a short fall season of high water and free navigation. In the winter ice and low water often obstructed navigation. Boating seasons seldom conformed to the ideal, and wet and dry, and good and bad years mixed in perplexing fashion. In the years 1832 and 1847 floods devestated the river; in 1819, 1838, 1841, 1854, and 1856 droughts dried it up. Boatmen generally considered the six consecutive years 1843 to 1848 good boating years.

Extreme low and high water both caused difficulties on the river but low water was the much more serious of the two because it occurred more frequently and because it lasted for prolonged periods. In September 1819 the Illinois Emigrant described the river as "literally seeking its way over pebbles to the great father of rivers, the Mississippi."[19] The Ohio reached a record low in the fall of that year, and the winter was so severe that the entire river system froze over. The Pittsburgh Gazette in March 1820 stated forlornly that the city had been "embargoed for eight months, by the low state of the water and by the ice."[20] The Lawrenceburg Political Beacon reported in September 1838, that "Steamboat navigation is entirely stopped above

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[18]Roberts, "1870 Survey," 24.

[19]Quotation from Illinois Emigrant in Niles Weekly Register, XII (September 25, 1819), 64.

[20]Quotation from Pittsburgh Gazette in Berry, Western Prices, 60.

Cincinnati, and but two or three of the very smallest class attempt to ply below."[21]

In 1854 the extremely low water in the Upper Ohio even exceeded the 1838 low, and 1856 was little better. Captain E. Bennett described the plight of the boatmen in those years: "I cannot say," he wrote in 1870, "that the boats have been stopped by low water more than in the summer of 1854 and 1856. In 1854 our boats were laid by 82 days, and a good part of that time there was no navigation for any steamboat of lighter draught (our boats draw 3 feet light)."[22] In these years low water again combined with freezing weather as in 1819-1820. In 1856 the delayed fall rise did not come until about December 5 and freezing weather began within two weeks completely closing the river with ice by December 24. Navigation did not begin again until February 7, 1857.[23] The "freeze-up" of 1854 lasted even longer, until March 6, 1855. The sequence of low water and ice in the 1850s recalled to many John Randolph's opposition to improvement of the Ohio on the ground that "it was frozen over one half of the year and dry the other half."[24]

The gentleness and serenity, the normal traits of the waters of the Ohio, occasionally gave way to fits of rampage and destruction called freshets. Floods came only at infrequent intervals, the most notable in 1772, 1784, 1813, 1815, 1832, and 1847. Floods prior to that of 1832

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[21]Lawrenceburg Political Beacon, September 29, 1838.

[22]Quotation from Roberts, "1870 Survey," 23.

[23]Louis C. Hunter, "Seasonal Aspects of the Economic Life of the Ohio Valley Before the Age of Big Business," Smith College Studies in History, XIX (Oct. 1933-Jan. 1934), 10.

[24]Ambler, A History of Transportation, 204-05.

caused little damage to either navigation or farms, but in that year the worst of the antebellum floods occurred.[25] At both Cincinnati and Louisville there was extensive damage to large sections.[26] Madison by comparison suffered little damage from the flood, because the town was on the second bank of the river "about thirty feet above high water mark." Townspeople estimated the loss at not more than six hundred dollars.[27] In the 1847 flood, high water did not reach the level of 1832, but did more damage to Madison because of the buildings that had been constructed on the first bottom in the intervening years.[28]

Even in good years, 1843 to 1848, boatmen could not rely on the capricious river. In 1843 there were 123 days when the water was not lower than 10 feet in the channel, but in 1844 there were only 76 days when it remained at that level. In 1845 there were 51 such days, but in 1846 and 1847, boatmen had 104 and 124 days, respectively, when the water was not lower than 10 feet. In 1848 the number of days dropped again, this time to 97.[29] What

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[25]R. Carlyle Buley, The Old Northwest; Pioneer Period, 1815-1840 (2 vols., Indianapolis, 1950), I, 434.

[26]E. S. Thomas, Reminiscences of the Last Sixty-Five Years (2 vols., Hartford, 1840), II, 150-51.

[27]Madison Indiana Republican, March 1, 1832.

[28]Indianapolis Indiana State Journal, December 24, 1847. Ironically, one of the worst antebellum floods experienced by Madison resulted from a freshet on Crooked Creek, which flows behind the town. In 1846, the Madison Weekly Courier reported it "the most devastating and destructive freshet that has ever been known in this neighborhood." Heavy rains in the uplands, carried off by Crooked Creek, caused the disaster, which took at least eight lives and caused an estimated "hundred thousand dollars" in property damage. Madison Weekly Courier, September 5, 1846.

[29]Roberts, "1870 Survey," 40.

made these generally good years for boatmen was that low-water periods were blessedly short.[30] The suspension of navigation because of ice also declined during these years.[31]

Advances in steamboat design contributed to making these favorable years for navigation of the Ohio. In 1818 the smaller class of steamboat (100-125 tons) required a depth of 6.5 feet in the channel for safe navigation while the larger class (400-500 tons) required 10 feet. By 1841 design had reduced the draft of these two classes so that they required 4.5 feet and 8 feet respectively. Further improvement by 1847 reduced the water level needed by steamboats for safe navigation, allowing the smaller class to run on 3.5 feet of water in the channel and the larger class to run on 6.5 feet. By 1843 small, light-draft steamboats drawing less than 3 feet, some not more than 15 to 16 inches, were also in operation on the river. Small sternwheelers, drawing only 8 inches and described somewhat contemptuously as the "mosquito fleet" appeared on the river around 1859.[32] Although the small light-draft vessels aided in making the forties generally good years on the river, they did not solve low-water transportation problems because they could carry little if any freight

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[30]During these years the river did not fall below 18 inches in the channel at Wheeling, and for two years, 1842 and 1845, it did not fall below 2 feet. In 1847 it fell below 3 feet for only fifteen days. Roberts, "1866 Survey," 270.

[31]Records at Louisville, which begin in 1846 show only one ten-day period of suspension of navigation because of ice, in the years between 1846 and 1849. Louisville Courier Journal, January 21, 1875.

[32]Louis C. Hunter, Steamboats on the Western Rivers: An Economic and Technical History (Cambridge, 1949), 75, 84-85.

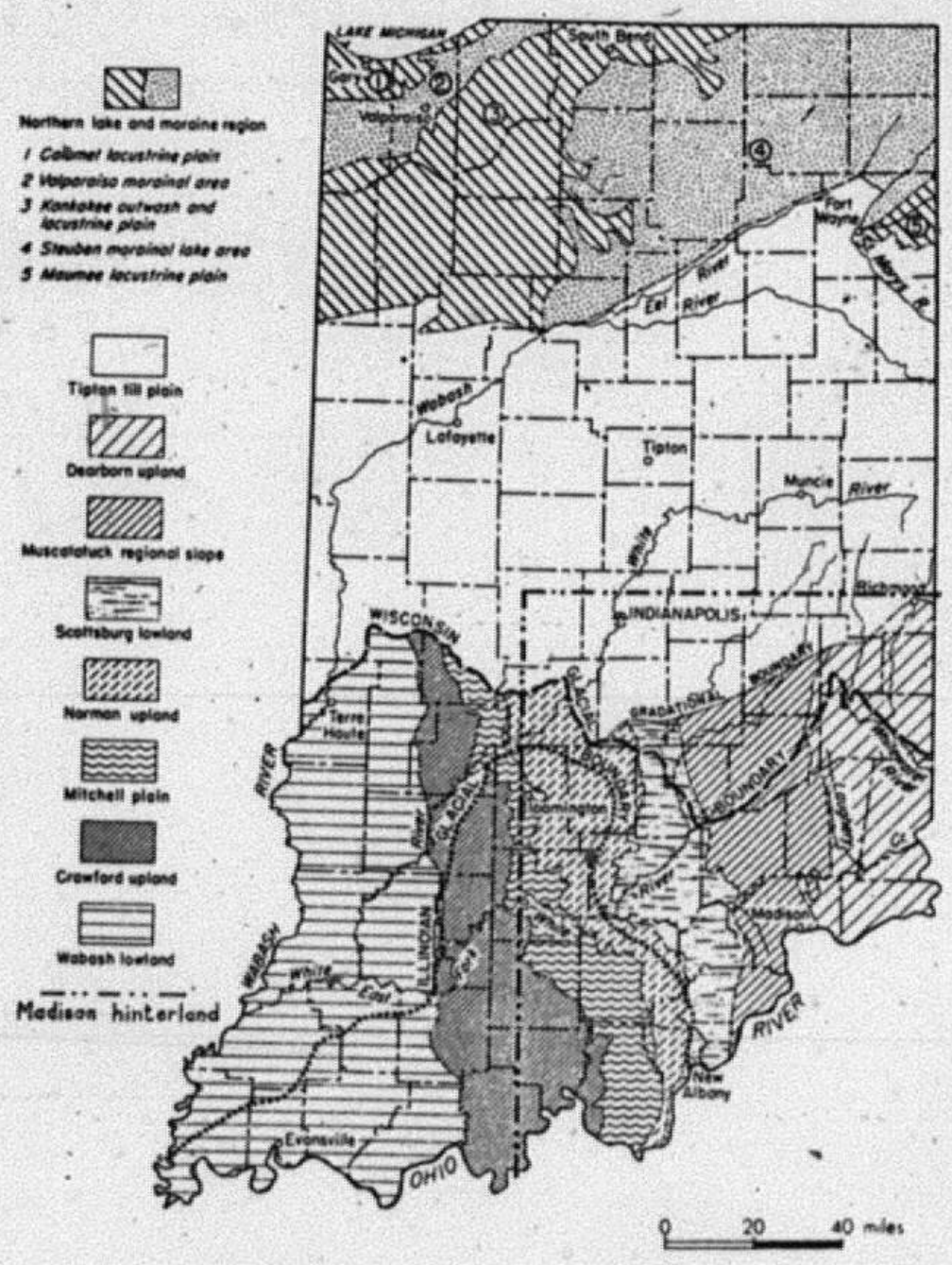

Figure 1. Physiographic Regions of Madison's Hinterland

Source: Robert C. Kingsbury, An Atlas of Indiana (Bloomington, 1970), 14.

and only a few passengers. Their advantage lay in preventing the complete stoppage of movement on the river.

The Ohio River influenced the development of Madison because it served as a highway that brought settlers into its hinterland and carried their produce to market. Broadly defined, this hinterland extended west from the eastern boundary of Indiana to a line running north and south 20 miles west of Indianapolis, and north from the Ohio River to the Old National Road (Figure 1).[33] The area included approximately five and a half million acres of land which had been only minimally developed in 1811 at the time of Madison's settlement.[34]

Glacial invasions and normal degradation processes, such as weathering and stream erosion, shaped the landforms that made up Madison's hinterland (Figure 2). The landforms extending from north to south divide the area into a "succession of uplands and lowlands bounded by relatively steep slopes or escarpments formed by the outcropping edges of hardened strata."[35] The easternmost of these divisions, the Dearborn Upland, begins on the bluffs of the Ohio River some 5 or 6 miles east of Madison. It tends in a north and easterly direction for about 75 miles until it merges

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[33]Both the distribution of central places and the development of transportation routes discussed in Chapter III suggest the theoretical boundary of Madison's hinterland used in this study.

[34]U. S., Agriculture of the United States in 1860: Compiled from the Original Returns of the Eighth Census (Washington, 1864), 38-42.

[35]Clyde A. Malott, "The Physiography of Indiana," Handbook of Indiana Geology (3 parts, Indianapolis, 1922), Part II, 83; the following description drawn from Malott, "Physiography in Indiana," Part II, 66-102, and A. F. Schneider, "Physiography," in Alton A. Lindsey, ed., Natural Features of Indiana (Indianapolis, 1966), 40-56.

Figure 2. Physiographic Diagram of Madison's Hinterland.

into the low relief Wisconsin glacial plain in the north. This upland is a plateau varying in height from 850 feet in the south to slightly over 1,100 feet in the north. Because the upland comprises the drainage basin of the Whitewater River and smaller basins, notably Laughery Creek, streams have deeply trenched its plain. In some places they have so dissected the plateau that little remains of upland surface. The high relief of the region (some valley floors lie as much as 450 feet below the upland surface) made early land travel across it difficult and limited the land available for development. In 1860 Ripley County had 117,487 of its 216,477 acres undeveloped.[36]

Madison lies on the southern edge of the Muscatatuck Regional Slope, which begins on the western slope of the Dearborn Upland, extends west and south for 25 or 30 miles and north of Madison some 60 miles until it merges indistinctly into the Scottsburg Lowland on the west and the glacial plain on the north (Figure 2). The eastern edge of the Slope has an elevation of 875 feet, gradually rising to the northward to about 1,100 feet. Its western edge is about 500 feet above sea level near the Ohio and about 725 feet in the north. In the southern part of the Slope valleys are steep sided and moderately deep. On the plain between the streams the land is typically quite flat. Stream entrenchment in the northern part is noticeably less advanced than in the south, and upland areas are generally very broad and nearly flat to undulating. The lower relief of this landform posed fewer obstacles to early land travel north and provided more land available for development than did the Dearborn Upland.

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[36] U. S., Agriculture of the United States in 1860, 42.

Farther west the Scottsburg Lowland (Figure 2) is a narrow plain of low relief broken by the streams which flow through the region. Elevation throughout the lowland is below 700 feet, and from southern Bartholomew County to the Ohio River it scarcely exceeds 600 feet. The valleys are very broad and flat, and the upland slopes adjacent to the valleys are gentle and usually without cliffs. Early land travel and development faced fewer obstacles because of land relief in this region than in any of the other divisions of Madison's hinterland south of the Wisconsin glacial boundary.

Immediately west of the Scottsburg Lowland a bold escarpment, known as the Knobstone or Norman Upland, towers hundreds of feet above the lowland (Figure 2). Near New Albany this plateau is 400 to 600 feet above the lowland to the east; as it moves northward it generally decreases in height until about 100 miles north of the Ohio it gradually disappears beneath the thick drift cover of the Wisconsin Glacier. Stream action has dissected the plateau, producing long, sharp ridges with altitudes of over 1,000 feet. The valleys descend sharply and deeply. Like the Dearborn Upland, the high relief of this landform offered many obstacles to early land travel to the north, and to the extensive development of land. In 1860 Brown County had improved only 33,791 of its 111,182 acres.[37]

Further to the west the Mitchell Plain inclines westward and slightly south, varying in height from less than 600 feet near the Ohio River to more than 900 feet on its northern margin (Figure 2). The feature of this plain is its great array of minor irregularities or sinkhole depressions. All streams crossing the Mitchell Plain from east to southwest are

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[37] Ibid., 38.

from 80 to 175 feet below the surface of the plain. Like the Scottsburg Lowland, the Mitchell Plain offered few natural obstacles to early land travel and development.

The rugged highland west of the Mitchell Plain, known as the Crawford Upland, contains the maximum of diversity in relief and variability in topographic form in Indiana (see most westerly land form in Figure 2). Its boundaries are marked by the Wisconsin glacial drift to the north, the Ohio River to the south and the Wabash Lowland to the west. This upland is a highly dissected westward sloping plateau varying in altitude from 348 feet on the Ohio River to 980 feet on its northern margin. Throughout the region are great variety of landforms and diversity of relief which inhibited early land travel and development. In 1860, 93,974 of Perry County's 131,108 acres remained unimproved.[38]

Generally the early travelers and settlers who traversed the broken, rolling, and sometimes even steep and precipitous, uplands and narrow linear plains of Madison's hinterland, spoke favorably of them. They described them as "high, dry, and healthy," apperently a prime requisite for settlement.[39] Another frequent comment concerned the region's "thousand aspects of grendeur and beauty," particularly the land near the Ohio.[40] When Jesse Vawter, one of the first to settle in the immediate vicinity of Madison, selected his land in December 1805, he chose the high ground

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[38] Ibid., 42.

[39] Isaac Reed, The Christian Traveller (New York, 1828), 217; Fordham, Personal Narrative, 101-02.

[40] Timothy Flint, A Condensed Geography and History of the Western States or the Mississippi Valley (2 vols., Cincinnati, 1828), II, 138.

behind the town over the richer bottom land bordering the river. The following spring of 1806 he settled there, and most of the settlements made in that year, and the two or three succeeding years, were located in the highlands.[41]

The early settler did not find the broken features of Madison's hinterland a deterrent to settlement and could satisfy his aesthetic interests becsuse of his limited land needs. Unaided and with primitive tools, according to one writer, a settler ordinarily took about three weeks to clear and burn an acre of land. Under these conditions it ordinarily required a settler six or seven years to clear a small farm.[42] Little wonder then, that the frequent strips of "rich bottom" or "prairie lands, from one to five miles wide" interested the early traveler and settler more than vast stretches of rolling land for which he had no need. If the land were high and well drained, which to him meant healthy, that was enough. When the New Purchase lands in the northern part of Madison's hinterland opened in 1818, the "great extent of rich lands...of which Indianapolis is the centre," settlers began to move farther and farther north,[43] but it was the broken land that had first attracted settlement

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[41]Reminiscence of John Vawter, Madison Daily Courier, April 4, 1874.

[42]E. C. Jerman, History and Directory of Ripley County (Versailles, Indiana, 1888), 65.

[43]Flint, A Condensed Geography, II, 139. By treaties made in October 1818, the State of Indiana extinguished the Indian title to the land lying south of the Wabash and Maumee rivers and a strip north of the Wabash lying between the Tippecanoe and Vermillion rivers. This was the largest purchase of land the government ever made in the state, and is known in Indiana history as the "New Purchase." Buley, Old Northwest, I, 36-37; George Pence and Nellie C. Armstrong, Indiana Boundaries Territory, State, and County (Indianapolis, 1933), 220-23.

and continued to attract it for the next several decades.

The soils of Madison's hinterland fall into four broad categories with some local variation: Wisconsin drift soils north of the Wisconsin glacial boundary; Illinoian drift soils south of that boundary; unglaciated soils in the area not covered by the several ice sheets; and the alluvial soils on the bottom land of its many streams and rivers.[44]

The best and more fertile soils are found north of the Wisconsin glacial boundary (Figure 1). These soils were particularly good for corn and wheat. When the area opened for settlement in 1819, Edmund Dana wrote that the fertility of the soil equaled that of "any part of the western country."[45] And Timothy Flint could write in 1828, "It is an unquestionable evidence of the fertility of the country in the interior of Indiana, that it was once the seat of the most dense Indian population in the western country. -- The Indians invariably fixed in greatest numbers where the soil was fertile, the country healthy, and the means of transportation on water courses easy and extensive."[46] Problems related to cultivation of the soil here were control of erosion on the sloping areas and maintenance of an adequate drainage system on the level and depressed areas.

The Illinois drift-derived soil falls into two general categories: that south of the Wisconsin glacial boundary and from the west slope of

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[44]This classification and the following discussion of soils is drawn primarily from a recent study by H. P. Ulrich, "Soils," in Lindsey, ed., Natural Features, 57-90.

[45]Edmund Dana, Geographical Sketches on the Western Country (Cincinnati, 1819), 109.

[46]Flint, A Condensed Geography, 139.

the Dearborn Upland across the Muscatatuck Regional Slope and the Scottsburg Plain to the base of the unglaciated region; and that in the southern and eastern section of the Dearborn Upland (Figures 1 and 2). The former soils are strongly acid and low in fertility, and are either subject to erosion or require drainage, but when properly managed are productive for most crops. In the southern and eastern section of the Dearborn Upland from 77 to 79 percent of the soils has been lost to erosion. In the remaining area of the Illinois soil, the degree of erosion depends to a large extent on the degradation of the land, ranging from 28 percent to as much as 50 percent in some areas.[47] The latter soil is strongly to very strongly acid and low in fertility. Because of the high relief of the region it too is subject to considerable erosion and requires careful cultivation. It is best suited for grass and meadow crops, and in it timber grows very slowly.

In their estimate of the fertility of the Illinois drift area soils early observers and recent writers disagree, and here most clearly in their estimates of the south and eastern portion of the Dearborn Upland. David Thomas in 1816 found the soil on the hills in this area "very fertile, and the vegetation uncommonly fine."[48] The following year Samuel R. Brown also praised the soil, finding it "free from stones,and easily cleared and ploughed," although he did note poorer soil on the spurs of the hills. On the hilltops he found the land "level and rich" and the soil "perculiarly adapted to the culture of small grain [wheat] and for

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[47]Stephen S. Visher, "Indiana Regional Contrasts in Soil Erosion and Their Chief Causes," Proceedings of the Indiana Academy of Science, XLVI (1937), 144-47.

[48]David Thomas, Travels Through the Western Country in the Summer of 1816 (Auburn, New York, 1819), 122.

grazing."[49] Flint in 1826 described the land as "poor and ridgy," "yet... I could hear on all sides the settlers' axe resounding, and the dogs barking,--sure indications that the land had been, as the phrase is, 'taken up.'"[50] Thomas' estimate of the Scottsburg lowland, predating 1840, does not differ as markedly from the soil evaluation of recent writers. Here, Thomas wrote, "The soil, through a space of twenty miles from this village [New Lexington] to the Knobs, like the level country over which we have passed, is a loam inclining to a stiff clay, and moderately fertile."[51]

The driftless soils of the unglaciated area have the lowest fertility in Madison's hinterland. The soils, strongly acid, and low in organic matter, nitrogen, and phosphorus, are best suited for grasslands, livestock farming, and some fruit tree cultivation. Because of the high relief in the area, soil erosion ranges from 75 percent to as much as 95 percent in some sections.[52]

Opinion differed among early travelers on the fertility of driftless soil, from highly critical to laudatory, but in general it was viewed as low in fertility. In 1819 Richard Lee Mason criticized the unglaciated area north of New Albany as "A poor, barren, deserted country. For ten miles, stony, poor, mountainous, and naked."[53] Samuel R. Brown, writing

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[49]Samuel R. Brown, The Western Gazetteer (Auburn, New York, 1817), 54.

[50]Timothy Flint, Recollections of the Last Ten Years, Passed in Occasional Residences and Journeyings in the Valley of the Mississippi (Boston, 1826), 56.

[51]Thomas, Travels Through the Western Country, 121.

[52]Visher, "Indiana Regional Contrasts in Soil Erosion," 46, 47.

[53]Richard Lee Mason, Narrative of Richard Lee Mason in the Pioneer West, 1819 (New York, n.d.), 34-35.

about the same time, balanced Mason's critical view by observing that Orange County had lands "equal in fertility of soil...to any county in the state."[54] Dana visited the driftless area in 1816 and gave perhaps the best appraisal when he judged "the soil in some parts thin and sterile, but generally productive."[55] David Thomas described the extent of the erosion that he saw there in the same year. "The sides of these hills," he wrote, "are deeply gullied, and peninsulated points appear like ribs attached to vertebrae. Some stand separate, or detached from the main mass, conically sloped; and high up the sides of one, a horizontal stratum of rock projects, which has the appearance of limestone. The wearing of water on these piles in some distant age must therefore have been very extraordinary."[56]

Alluvial soils are widely distributed throughout Madison's hinterland. They occur on formerly forested flood plains of major and minor streams, the overflow of which formed the soil from deposited alluvium. They are fertile and well supplied with organic matter and plant nutrients. Virtually every early observer of the soil reported the high fertility and desirability of the alluvial bottom lands. In 1819 David Warden wrote that "Along all the principal streams...there is a tract of rich alluvial soil."[57] Only occasionally did an observer criticize the bottom land

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[54]Brown, Western Gazetteer, 64-65.

[55]Dana, Geographical Sketches, 122.

[56]Thomas, Travels Through the Western Country, 122.

[57]David B. Warden, A Statistical, Political and Historical Account of the United States of North America (2 vols., Edinburgh, 1819), II, 280-81.

because its high organic content gave off "unhealthy fumes."

Throughout the Madison hinterland a higher level of fertility obtained during the early years of settlement, if only because of the organic matter and plant nutrients the soil had received from ages of deposition of the broad leaf forest that extended over the entire area. So extensive and dense was that forest that Morris Birkbeck could write:

> To travel day after day among trees of a hundred feet high, without a glimpse of the surrounding country, is oppressive to a degree which those cannot conceive who have not experienced it; and it must depress the spirits of the solitary settler to pass years in this state. His visible horizon extends no farther than the tops of the trees which bound his plantation -- perhaps five hundred yards. Upwards he sees the sun, and sky, and stars; but around him an eternal forest from which he can never hope to emerge.[58]

A recent study of the indigenous forests of Indiana, for the period from about 1793 to 1843, has identified three types of forests found in the Madison hinterland--Western Mesophytic, Beech-maple, Oak-hickory.[59]

The Mitchell Plain and steeper slopes of the Ohio River, and the Laughery Creek drainage basin of the Dearborn Upland, contained most of the Western Mesophytic forest. Beech was the dominant species, along with sugar maple, tulip poplar, white ash, basswood, walnut, white and red oak, red elm, and black gum. The steep slopes and highly dissected topography of most of this region discouraged extensive clearing of the forest for agriculture.

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[58]Morris Birkbeck, Notes on a Journey in America, From the Coast of Virginia to the Territory of Illinois (Dublin, 1818), 117-18.

[59]Much of the following description comes from R. O. Petty and M. T. Jackson, "Plant Communities," in Lindsey, ed., Natural Features, 279-91, and Richard S. Fisher, M. D., Indiana: in Its Geography, Statistics, Institutions, County Topography, Etc. (New York, 1852), 59-103.

The beech-maple dominated most of the Muscatatuck Regional Slope, the Scottsburg Plain, the upper elevations of the southeastern portion of the Dearborn Upland, and all the area north of the Wisconsin glacial boundary. Because beech was never a valuable timber tree, selective logging removed the higher grade species such as walnut, white oak, tulip poplar, and ash also found in this forest. The beech-maple forest usually occupied the best soils and suffered most from land improvement.

Oak-hickory forest concentrated in the driftless uplands and in the northern portion of the Dearborn Upland. In the lowlands of these areas, species such as bur oak, pin oak, swamp white oak, Shumard's oak, shellback hickory and bitternut hickory dominated; on the dry ridges of the driftless area chestnut oak, scarlet oak, post oak, and mockernut hickory. At the time of the early settlement of the Madison hinterland, beech and maple were replacing the oak-hickory forests, but selective logging practices of the early settlers accelerated this process.

This great broadleaf forest housed numerous game animals, including bear, deer, wild turkeys, and wild pigeons, that provided the early settlers with food. Walnuts, hickory nuts and hazel nuts, and oak and beech mast furnished the bulk of the food, sometimes the only food, for the feeding and fattening of hogs. As Thomas reported, "It is not uncommon for a farmer to kill one hundred hogs and receive six hundred dollars for them, without giving them one ear of corn."[60]

The native fruit trees of these forests also provided the settler with food. The wild plum, hawthorn, persimmon, pawpaw, and other fruits

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[60]Thomas, Travels Through the Western Country, 207.

and berries grew there in abundance. According to Thomas "the scent and flavor are too luscious to be agreeable to those who are unused to [the pawpaw]; but the disgust soon abates and we find it highly delicious."[61] Wild grapes grew in such abundance that their vines hung "like cables... from the tops of the trees in every direction."[62] In the early years the sugar maple provided perhaps the pioneers' only sugar. In 1816, Thomas found "little of this article from New Orleans since we left Pittsburgh."[63]

In early years the forests supplied the settlers with virtually all the building materials needed for home and industry. The tulip tree, large, easily felled, and straight-grained, furnished lumber for many houses and barns. These trees, which sometimes reached diameters of 12 feet above the butt swell, were split by pioneers into six-inch-thick planks and dressed with a broadax. The high popularity of the tulip tree for building probably resulted from the ability of its wood to repel termites, which the pioneer may have learned from experience.[64]

The forests yielded early settlers almost their only fuel and fencing material. "Wood for fuel and for fences," Thomas wrote in 1816, "is an object of such importance to the farmer, that none is yet found willing to forego that convenience, and to seat himself out in the prairie."[65]

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[61] Ibid., 208.

[62] Ibid., 112.

[63] Ibid., 133. One settler in 1836 reported preparing 1,000 pounds of maple sugar from about 300 maple trees. Translated and edited by Emma S. Vonnegut, The Schramm Letters (1836), (Indianapolis, 1935), 287-88.

[64] Lindsey, ed., Natural Features, xix.

[65] Thomas, Travels Through the Western Country, 155.

The strong, hard, white oak provided a valuable manufacturing material for home and industry. Attaining heights from 100 to 140 feet, with a trunk from 4 to 6 feet in diameter, it furnished abundant material for the manufacture of agricultural implements, carriages and wagons, cooperage, furniture, and boat-building. Next to ash, industry preferred shellbark hickory in the manufacture of carriages and agricultural implements, and for fuel, while it used its bark in tanning.[66]

The leaf mold from the trees, often with a thickness measured in feet, formed the greatest water storage Madison's hinterland ever had.[67] Trapping and storing the abundant rainfall in this region, leaf-mold reservoirs fed an almost continual flow of water into its extensive river system. This system falls into three main divisions: the minor Ohio River tributaries; the Whitewater River drainage basin; and the southeastern portion of the Wabash River drainage basin (Figure 3).[68]

Minor Ohio River tributaries, extending from Tanners Creek on the east to Oil Creek on the west, empty directly into the Ohio. The longest of these, Blue River and Laughery Creek, have their source about 40 running miles from the Ohio, while the majority head within 20 miles of the river. With the exception of Silver Creek in the Scottsburg Lowland, all have their heads in high rugged land, making them swift-moving during high water. Few surface tributaries contribute water to these streams, although many

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[66]Lippincott, History of Manufactures, 12.

[67]W. M. Tucker, "Hydrology of Indiana," Handbook of Indiana Geology, Part III, 278.

[68]Much of the material on rivers comes primarily from Malott, "Physiography of Indiana," 73-80; and Tucker, "Hydrology of Indiana," 257-402.

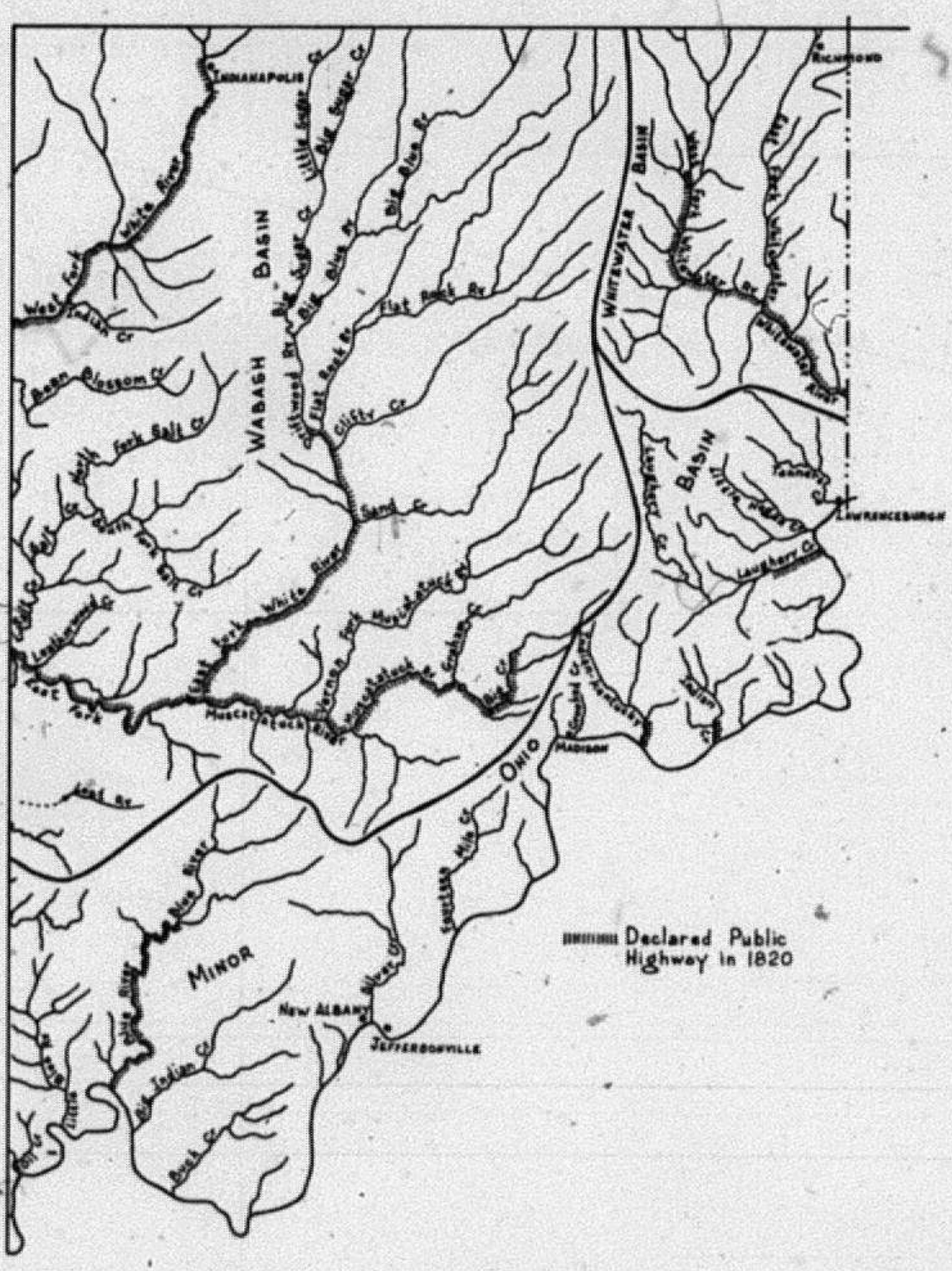

Figure 3. River System of Madison Hinterland.

Source: Laws of Indiana (1819-1820), 58-60.

large springs drain into them. This limited their use for navigation, while at the same time making them more useful as mill streams, because the springs kept the water flowing.

The Whitewater River drainage basin comprises the northern half of the Dearborn Upland (Figure 3). Whitewater River, in its headwater portion, consists of two main forks, which flow south and slightly west until near the southern margin of the basin, where the west fork turns abruptly eastward. The East Fork enters the West Fork near Brookville, forming the Whitewater proper, which flows southeast out of Indiana. After crossing the Indiana-Ohio line the Whitewater joins the Big Miami River, which enters the Ohio River where the Ohio becomes the Indiana state boundary. The steep gradient of the Dearborn Upland gives the Whitewater a swift-moving current. Its headwaters have an elevation of slightly over 1,100 feet, while the Ohio has an elevation of about 425 feet. Since most of the Whitewater's tributaries are short, and the fall from the upland headwaters great, these streams have trenched the upland plain deeply. Erosion has produced sediment, which the swifter-moving Whitewater has carried to the slowly moving Ohio and deposited in the form of sand bars at the mouth of the Big Miami. The large volume of water carried by the Whitewater made it well adapted for navigation, and its swift currents were aptly suited for operating mills.

The East and West Forks of the White River, which drain into the Wabash River, form the third and largest river systems of Madison's hinterland (Figure 3). The two forks rise near the middle eastern side of the state (the Whitewater also rises here--Figure 1) the highest land (elevation 1,285 feet) in Indiana. The West Fork flows in a westerly

direction to just north and east of Indianapolis, where it turns and heads almost due south. From Indianapolis the river takes a southwesterly course to north of Petersburg, where it joins with the East Fork. The West Fork drains a narrow basin, receiving only a few important tributaries--Fall and Eagle Creek at Indianapolis, White Lick Creek near Martinsville, and Beanblossom Creek near Gosport.

The East Fork, along with the lower White River, forms the principal drainage basin of the Madison hinterland. The East Fork and its parallel tributaries flow south from their sources in a tortuous, winding manner until they join in the Scottsburg Lowland around Columbus. Above the mouth of the Muscatatuck, which enters from the east, the current of the East Fork flows swiftly; below, the waters become sluggish. From this junction, the East Fork follows a westerly course until it crosses the Mitchell Plain where it takes a south and westerly course through the Crawford Upland. On the Wabash Lowland it resumes a westerly course, and joins the West Fork north of Petersburg. The White River flows into the Wabash below Vincennes (Figure 1).

Indiana in 1820 recognized the importance of the river system of the state by declaring a number of rivers public highways (Figure 3). Among minor Ohio tributaries the state declared that Laughery Creek from its mouth to Hartford; the lower portions of Oil Creek, Indian Creek, and the Indian-Kentucky, and Big Blue River from its mouth to the town of Fredericksburg, should be such highways. It declared the Whitewater River a public highway from where it crossed the Indiana-Ohio state line to the fork of the river, and from there, the West Fork to the northern boundary of Fayette County. The act declared the White River a highway "from its

mouth to the main forks, the west fork from thence to the Delaware towns, the east fork from its junction with the west fork to the main fork, above the mouth of flat rock; Muscatatuck, from its mouth to the main forks, the north fork to the town of Vernon, the south fork, from its junction of the main forks, to the mouth of Graham's fork." The act specifically prohibited the placing of any obstruction to navigation except dams of "public utility," that provided locks for safe passage around obstructions.[69]

A much greater volume of water flowed in these streams during the early years of settlement than in later years, making them useful for mill streams and navigation.[70] In an early advertisement of a St. Omar lot sale the promoters called attention to the fact that the town was only "three quarters of a mile from the navigable waters of the Flat Rock, where boats pass down to New Orleans."[71] The advance of settlement and primitive agricultural practices of settlers destroyed much of the woodlands and the moss and leaf mold reservoirs that held the water and contributed to the usefulness of the streams for navigation. Settlement made freshets, such as the one that struck Madison in 1846, more frequent on these streams, though none other was as severe. More commonly freshets temporarily disrupted communication and travel in local areas. In 1830 the stage between Indianapolis and Madison foundered in such a freshet at the crossing of the south fork of the Muscatatuck at Vernon, causing damage to the vehicle

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[69] Laws of Indiana (1819-1820), 58-60.

[70] Charles F. Coffin, "Personal Reminiscences of Charles F. Coffin of Wayne County, Indiana from 1824 to 1833," in Harlow Lindley, ed., Indiana as Seen by Early Travelers (Indianapolis, 1916), 533.

[71] Quotation from Lewis A. Harding, ed., History of Decatur County Indiana (Indianapolis, 1915), 393.

and contents.[72] In flowing to the east and west, and directly into the Ohio, these streams carried the produce of the hinterland away from Madison rather than toward it. Thus the decline in the usefulness of these rivers for navigation did not work to the disadvantage of Madison's growth but probably contributed to it.

Climate and weather represent the last, and in some ways the most significant, of the ecological features of Madison's hinterland.[73] As Louis Hunter has written, "before 1850 and in some fields later -- industry and commerce were as dependent upon weather conditions as was agriculture. Then the almanac was the friend of merchant and manufacturer as well as the farmers."[74] Long-term records for the climate of Madison's hinterland unfortunately do not exist, although early writers spoke of the moderate nature of its weather.[75] C. F. Volney, a French traveler, in describing the weather of the Ohio Valley above Louisville in 1796 reported that cold weather was felt for only 40 or 50 days in the winter with snow commonly remaining on the ground from three to ten days. Spring brought warm rains but within 40 days after the equinox the summer heat began. This heat reached its greatest intensity during the 60 or 70 days that succeeded

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[72]Madison Indiana Republican, August 5, 1830.

[73]Temperature and precipitation, along with cloud cover, storminess, humidity, windiness, and the like are what is usually meant by weather. Climate generally means the sum total of the average of these conditions over a long period of time, usually not less than a decade. Since temperature and precipitation reflect the influences of the other attributes of weather, they provide a convenient measure of climate generally.

[74]Hunter, "Seasonal Aspects of the Economic Life of the Ohio Valley," 6.

[75]Stephen S. Visher, "Indiana Regional Contrasts in Temperature and Precipitation," Proceedings of the Indiana Academy of Science, XLV (1936), 183.

the summer solstice when temperatures reached 90 degrees and above producing an "oppressive heat." With the autumn equinox, rains came bringing with them the coolness that prepared the way for frost. The whole autumn, Volney wrote, "is serene, temperate, and the most pleasant" of all the seasons.[76]

Stephen S. Visher, using aggregate records dating from about 1870, has described the climate of Madison's hinterland. His description substantially agrees with that of Volney and other fragmentary early records. Visher described the climate as having well-marked seasonal changes, with hot summers and cold winters dividing temperate spring and fall seasons. On the basis of average temperatures of day and night together, he found the region had about 100 hot days, with temperatures averaging 68 degrees or over. Of these as many as 37 days in the extreme south and as few as fifteen to seventeen days in the north reached 90 degree temperatures or more.[77] In 1819 a Madison weather suvey taken for the month of August showed eleven of the first fifteen days of that month with temperatures at 90 degrees or above, with a high of 96 degrees.[78] The number of cold days when the average temperature for day and night together fell below freezing varied from none in the extreme south to about 65 days in the north, the coldest months being January and February.[79] On February 2, 1830, the

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[76]C. F. Volney, View of the Climate and Soil of the United States of America (London, 1804), 148-150.

[77]Visher, "Indiana Regional Contrasts in Temperature and Precipitation," 188; Stephen S. Visher, Climate of Indiana (Bloomington, 1944), 19.

[78]Madison Indiana Republican, September 7, 1819.

[79]Visher, Climate of Indiana, 19.

temperature in Madison reached ten degrees below zero, the coldest weather since 1821.[80] Cold spells could, and frequently did occur earlier. In 1819, Madison reported snow falling "To the depth of an inch and remained visible near twelve hours" as early as October 16.[81]

The average temperature of the remaining days that were neither hot nor cold divided about equally in the region between warm (50 degrees to 68 degrees) and cool (32 degrees to 50 degrees) days. The last killing frost occurred about April 20, and the first killing frost about October 15. This gave a growing season of between 160 and 180 days, with the longest season being along the Ohio and decreasing toward the north.[82] Length of the growing season and the high summer temperatures made the climate suitable for corn, but other crops, such as wheat, oats, and grasses also did well.

Precipitation varied over the region from an average of 40 inches in the north to 45 inches in the south. This was fairly evenly distributed throughout the year, with 12 inches falling in the spring; about 11 inches in the summer; between 8 and 10 inches in the autumn; and between 10 and 12 inches in the winter.[83]

Drought and deluge posed two serious problems in Madison's hinterland. In the 50 years between 1811 and 1860, no less than seven summers were reported dry: 1819, 1820, 1830, 1834, 1854 and 1856. In the summer of

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[80]Madison Indiana Republican, February 3, 1830.

[81]Ibid., October 16, 1819.

[82]Stephen S. Visher, Economic Geography of Indiana (New York, 1923), 79.

[83]Visher, "Indiana Regional Contrasts in Temperature and Precipitation," 199-201.

1819 nearly three months passed without enough rain to "lay the dust."[84] In the summer of 1838 record high temperatures and drought combined to leave "little vegetation," and what remained was "being eaten up by the grasshoppers."[85]

Drought produced immediate and often severe effects; but the effects of deluge on the soil, though not as apparent, were more severe. Since precipitation was evenly distributed, about half of it fell during the cooler months when it was least needed, and often in the form of heavy rains. The temporarily swollen rivers caused extensive erosion. Even more harmful, heavy rains necessarily produced a great runoff (an inch of rainfall normally saturated the ground in cool weather) which eroded and carried away the soil on even fairly gentle slopes.[86] "Many of the long-cultivated steeper slopes of Southern Indiana," Visher has written, "have lost so much of their soil as to have become distinctly infertile."[87]

Madison's natural environment presents a picture of immediate advantage for town-building and serious long-range weaknesses. Its location above all but the most severe floods of the Ohio River protected Madison residents and businesses from the heavy losses incurred by other river towns while at the same time affording the commercial advantage of settlement on the river's shores. The river's seasonal aspects--low water and frozen winters--offered severe limits to use. In a preindustrial age such

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[84]Madison Indiana Republican, October 9, 1819.

[85]Lawrenceburg Political Beacon, August 11, 1838.

[86]Visher, "Indiana Regional Contrasts in Soil Erosion," 155-59.

[87]Stephen S. Visher, "The Geography of Indiana," Handbook of Indiana Geology, Part I, 15.

limitations meant inconvenience more than restriction to growth. In the summer the farmer ordinarily produced little for export, and the merchant need only be aware of interruptions in commerce to gear his imports to them. Cold and ice that caused frozen rivers produced inconvenience but not hardship, and even benefitted some early industry such as meat packing. Only as the preindustrial gave way to the industrial age did the seasonal aspects of Madison's environment cease to be inconveniences and become limitations.

Other features of Madison's hinterland present a similar picture. Only the river system moving away from Madison rather than toward it appeared an immediate limitation to growth; topography, soil, vegetation, and climate all apparently provided advantages. But immediate benefits vied with long-range weaknesses. Rainfall contributed to travel and shipping and to a climate that made possible the growing of most crops, but it eroded the soil, reducing its fertility. Most important, apart from limestone, Madison's hinterland lacked any significant deposits of natural resources--oil, coal, gas, or iron--necessary for growth in the industrial age. In sum, then, Madison's natural environment provided reasons for short-term growth which gave the city builders the right to believe they had chosen well. Long-term growth would prove another matter.

Appendix A

Ohio River-Pool Lengths and Distances from Cincinnati to Louisville

	Total Distance from Pittsburgh to Head of Pools	Length of Pools [7 Feet or Over Depth at Low Water]	Aggregate Pool Length
Cincinnati	467.5	3.5	Cincinnati
467 miles	471.5	10.5	
	482.5	2.5	
	485.5	2.0	
	488.5	6.0	
	495.0	2.0	
	497.5	0.5	
	499.0	2.0	
	501.5	0.5	
	502.5	0.5	
86 miles	504.0	5.5	67 miles
	510.5	2.0	
	513.0	9.0	
	523.0	1.5	
	526.0	4.5	
	531.0	2.0	
	533.5	0.5	
	536.0	1.0	
	538.0	1.5	
	541.0	3.0	
	545.0	4.5	
	551.0	1.0	
Madison	552.5	5.0	Madison
553 miles	558.0	12.0	
	571.0	7.0	
43 miles	579.0	2.5	39.5 miles
	589.0 [Sic]	5.5	
	588.0	11.0	
Louisville			Louisville
596 miles			

Source: W. Milnor Roberts, "Survey of the Ohio River" (1870), U. S., House Executive Document, No. 72, 41 Cong., 3 Sess. (Serial 1454), 153.